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ABSTRACT

In an effort to examine the pragmatic effects of definitions of learning disabilities and identification procedures, information was gathered on the characteristics of 53 children (grades 1 through 7) who had been previously diagnosed as learning disabled. Results of tests such as the Wechsler Intelligence Scale for Children and the Illinois Test of Psycholinguistic Abilities were subjected to hierarchical grouping and discriminant analysis in an attempt to define similar characteristics separating the variables into the most homogeneous groups possible. Results indicated that intelligence and visual perceptual skills were the distinct roots differentiating the following groups: low intelligence factor with a severe visual perceptual problem, average intelligence factor with a severe visual perceptual problem, average intelligence factor with a low visual perceptual problem, and high intelligence factor with a moderate visual perceptual problem. Results suggested the need to reexamine identification procedures and differentiate educational prescriptions based on the group characteristics designated by the analysis. (DB)

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A Model for Learning Disabilities as a Prerequisite to the Evaluation of a Prescriptive Instructional System

by

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A Model for Learning Disabilities as a Prerequisite to the Evaluation of a Prescriptive Instructional System

The field of learning disabilities is relatively new, but it is growing at a rapid rate. This group of children with learning disabilities is not a homogenous group. It includes children with various psychological and educational developmental deficits but who have intact sensory, physical, and intellectual attributes. They have been variously labeled, depending not only on their type of difficulty but on the professional discipline that makes the diagnosis. Because so many diverse professions are concerned, a confusion of terminology, incidence, and classification pervade current discussions found in the literature.

The purpose of the present study was to develop a useful model composed of characteristics of learning disabilities as defined by the grouping procedure used and the analytical approach used in separating common group characteristics. The literature review revealed that there is no one known accurate classification method for learning disabilities. The field is too broad and ambiguous for any one global definition to be used. The emphasis in the past has been placed on the "uniqueness" of every child. The question this study proposed was "Are there no sensible grouping procedures available based on common characteristics among a group of learning disabled children? An attempt was made to deal with the problem of classification from an empirical and analytical frame of reference.

Studies of children with learning disabilities have used a wide variety of criteria to determine their unique characteristics. The criteria used have changed as a function of the sensitivity of the

assessment techniques as well as of the investigator's ability to coordinate and integrate information. An example of the type of input that might be gathered as criteria for a child suspected of learning disabilities shows just how complex an evaluation might become--medical history, physical findings, neurological signs, biochemical data, EEG patterns, behavior ratings by parents and teachers, and scores on a large number of psychological tests.

Children with difficulties in language and visual-perceptual-motor skills and gross motor control have been considered to manifest cerebral dysfunction, perceptual handicap, maturational lag, minimal brain damage, developmental aphasia, neurological handicap, etc. (Clements, 1965). Later as they perform inadequately in the tool subject of reading, spelling, arithmetic and writing, they may be described as having dyslexia, dyscalculia, specific language disability or learning disability.

Concern with these children has rapidly increased in the last decade until it is now one of the leading complex and challenging problems facing special educators. Due to the diffuse number of definitions and confusion in terminology concerning learning disabilities, it would be extremely difficult to compose an inclusive and universally acceptable definition. In a study by Vaughan and Hodges (1973) one hundred practitioners in the field of special education were asked to respond both to specific and to generic definitions of learning disabilities. The most acceptable definitions tended to be based on psychoeducational definitions, with the most popular being concerned with a significant discrepancy between achievement and potential

capacity: "A child with a learning disability is any child who demonstrates a significant discrepancy in acquiring the academic and social skills in accordance with his assessed capacity to obtain these skills. In general, these discrepancies are associated with specific disabilities such as: gross motor, visual memory, visual discrimination, and other language related disabilities" (Baer & McDonald, 1972).

A variety of estimates of the prevelance of children with learning disabilities have been made, depending on the criteria used to determine the disability (Lerner, 1971). Myklebust and Boshes (1969) based their identification criterion on an educational discrepancy definition of learning disabilities and found 15 percent of the research population identified as underachievers. Approximately 7 1/2 percent of this population met their criterion for learning disabilities. A more conservative estimate of the prevalence of children with learning disabilities has been made by the National Advisory Committee on Handicapped Children (1968) in their report to Congress. They recommended that 1 to 3 percent of the school population be considered as a prevalence estimate.

Many recent articles and symposiums have discussed the confusion resulting from conflicting terminologies, assumptions of etiology, and plans for intervention (Clements, 1965; Michael-Smith, and Morgenstern, 1965, Bateman, 1964, etc.). Controversy over etiology came first: are these children neurologically impaired and/or brain damaged, emotionally disturbed, or culturally deprived and understimulated? Then came the controversy over the major area of the child's disability: is it visual-perceptual, perceptual-motor, specific language disability,

general clumsiness, stimulus-bound behavior, hyperactivity, short attention spans, etc.? This was followed by the related controversy over educational programming: do these children need training in visual-perceptual-motor skills, in auditory discrimination and language usage, body coordination exercises, special classrooms, individual cubicles, special tutoring and resource rooms? One of the present most useful models has been the information processing model as it promotes understanding of the complex interaction of the child's learning skills and provides a framework for developing programs to assist him to be more efficient in processing information in the classroom (Kirk and McCarthy, 1961). The construct of psychoneurological efficiency advanced by Myklebust and Boshes (1960) and Luria (1961) indicates that the efficiency of the child's behavior is dependent upon both his neurological intactness and his past experience. The psychoeducational analysis determined what type of learning disability is present by delineating specific problem areas which are then further diagnosed and assessed. This philosophy considers learning disabilities an educational concept with the focus more on behavioral diagnosis and remediation rather than on biological etiology (Kirk and Kirk, 1971). Research projects dealing with prediction and prevention of learning disabilities, assessment and identification, perceptual and ability training, visual and sensory motor training, and numerous other studies have crowded the literature. Their ambiguities have produced further probiems ofr the educators of learning disabled children.

One of the main problems noted in the review of the literature was the stress placed on the uniqueness of every child suspected of

a learning disability. Thus, in theory, every child could require a definition specific for his problems. There are, however, common characteristics of learning disabled children that can be found in more than one child in a classroom. This study sought to investigate the common characteristics found within a group of learning disabled children. In view of the difficulty brought on by treating each element of a learning disabled child as unique, it seemed that some grouping procedure could benefit those involved in diagnosing and writing appropriate remedial procedures for each child.

Procedure

Every child diagnosed learning disabled is not unique in all his characteristics of behavior. There are elements that he has in common with other children diagnosed with similar problems. How can one go about developing a useful grouping procedure for characteristics of learning disabled children? In order to investigate this notion a study was designed to develop a useful model composed of the characteristics of learning disabilities as defined by the diagnostic instruments and behavior correlates analyzed.

Fifty-three children previously diagnosed as learning disabled were used as the variables in this study. They were involved in a resource room approach to educational treatment of their problems in a Title III project at Sparta, Illinois. The age ranges were from first through seventh grade. The children were in a regular classroom situation and came to the resource room once a day for special instruction. Each teacher filled out a behavior checklist containing sixty-seven items for each child. Data involving specific test score

information (scaled scores, mental ages, IQ's, developmental ages, psycholinguistic ages, grade level ages) from the following tests were collected and scored on Opscan sheets for further analysis: Wechsler Intelligence Scale for Children, Illinois Test of Psycholinguistic Abilities, Bender-Bestalt Visual Motor Test for Children, Wepman Auditory Discrimination Test.

By using two analytical techniques, hierarchical grouping and discriminant analysis, an attempt was made to define the similar characteristics separating the variables into the most homogenous groups possible (Table 1). Similar patterns of relationships between the variables that cause a homogeneous grouping of subjects into certain clusters was determined through the use of hierarchical grouping (Table 4). The HGROUP program utilized the total within-group variation as the function to be minimally increased at each step in the process. A principal component factor analysis procedure was used on the behavior checklist in order to help avoid overweighting particular sources of variation through the use of factor rather than the original variables (Tables 2, 3). The observations that best define the characteristics of the group clusters obtained from the use of hierarchical grouping was determined through the use of discriminant analysis. Discriminant analysis maximized the distance between the four groups accounting for the maximum amount of space contributing to the discrimination among the groups. The discriminant function gives the "best" prediction, in the least-squares sense, of the "correct" group membership of each member of the sample. Discriminant analysis provided chi-squares, correlation matrix, univariate F tests, group means, and the range of centroid points for the designated number of roots.

This information was used in table form to indicate a multiplicity of relationships between variables which were relevant to the research questions (Tables 4, 5, 6, and 7).

Conclusions

Results

The data analysis was designed to test three major research questions:

1. Given 53 variables each measures on 41 different observations, to what extent does there exist natural groups among the 53 variables which are the most similar in their scores on the 41 observations used to describe them?

2. What are a set number of interpretable factors on the teacher behavior checklist that can be used to balance the weight of the behavior checklist observations with the other test score observations for the subject variables?

3. Given the most homogenous groupings of 53 variables measured on 41 different observations, what characteristics are significantly distinguishing each group from one another?

In order to equalize the weights for the variables needed in question 1, a principal component factor analysis was used (Question 2) to reduce the behavior checklist items into a smaller set of uncorrelated observations containing the most important information from the original items. This procedure balanced the weight of the behavior checklist observations with the other test score observations for the subject variables. The eight interpretable factors extracted were distractibility, comprehension-memory cognitive problems, visual perception problems, perseveration-memory problems, abstract spatial and temporal concepts problems, emotional lability, visual dissociation, and auditory-perceptual problems (Table 2). Because not all questions had the same response order, each

loading was multiplied by a +1 or -1 weight to obtain the consistency needed for the evaluation.

Research Question 1 was concerned with identifying common groupings among the variables based on similarities on the test score and behavior checklist information used to describe them. An arbitrary decision was made based on the proportional increase in error resulting at each level of group combination. There was a 4 point increase in error from G5 to G4 (G5 Errors 87.5, G4 Error = 91.4) and a 25.8 increase in error from G4 to G3 (G3 = Error 117.2) (Table 4). This large increment indicated that information was being forfeited from G4 to G3 that would indicate distinct characteristics that separate one group from another. With a 4 Group solution the amount of error is still at minimum when groups are combined. At a three group solution, however, the jump in error indicates gropus have been combined from G3 to G4 that no longer specify a minimum increase in error and thus, there are possibly two independent groups involved. The possibility of the combination of two independent groups was denoted by the increase in error.

In order to test the notion that there are four distinct groups that are most similar based on their observations, discriminant analysis was applied. HGROUP can only be used to describe the possibility of the most naturally occurring groups. It cannot, however, provide information for determining the characteristics separating the groups or the inforamtion to plot the group points in order to interpret whether or not these are separate and distinct groups. Discriminant analysis was applied to the four groups and the three group solution of hierarchical grouping analysis. When plotted, it was found

that the four group solution indicated four distinct and separate group centroids (Figures 1, 2, and 3). Thus, a three group solution would indicate one group composed in actuality of two independent groups. In order to obtain the most parsimonious answer to Research Question 3, "What characteristics are significantly distinguishing each group from one another," discriminant analysis was applied to several combinations of the variables.

After examining the results of applying DSCRIM to all 41 variables, it was felt that the additive property might be affecting the results (Total of subtests = composite scores) (Table 5, Figure 1). The results were indicating general intelligence and visual perceptual problems as the two basic characteristics separating the four groups. The results of an analysis of the subtest scores pointed to the same descriptives (g factor and visual perceptual problems) in separating the four groups. The last DISCRIM analysis took into account only the variables that were significant in the results of the subtest DISCRIM analysis (Table 5, Figure 3). The results indicated on Root 1, significant factors loading with high correlations that described the 'g' factor of intelligence-WISC subtest-General information, general comprehension, arithmetic, similarities, picture completion, picture arrangement, ITPA subtest-auditory reception, visual reception, auditory association, visual association, verbal expression, Behavior checklist factor-Visual Dissociation. Significant high loading factors on Root I, were ITPA subtests--visual closure, behavior checklist factors--Visual Perception Problem, and Perseveration-Memory Problem (Table 5). The highest loading factor on Root I was the WISC subtest-General information.

The highest loading factor on Root II was the ITPA subtest-Visual Closure. On Root II, possible visual perceptual problems are being indicated.

The results indicated two distinct roots that are maximally separating four distinct groups from one another. Root I indicates high-low differentiations of general intelligence. Root II indicates high-low differentations of visual perceptual problems.

Implications

The intuitive classification policy that the members of the Title III team at Sparta, Illinois, used has been captured in the analysis. The analysis points to a policy based on a range of intelligence factors and the presence or absence of visual perceptual problems. The review of the literature indicated a heavy emphasis being placed on whether or not a child has perceptual problems and specifications in his range of intelligence as two crucial factors in determining the presence or absence of learning disabilities. Definitions of learning disabilities stressed the importance of the presence of "near average or above general intelligence" with possible combinations of deficits in perception, conceptualizing, language, memory, and control of attention, impulse or motor functions (Clements & Peters, 1967)". In teacher education courses this generalized type of definition is stressed over and over again. Finding these two characteristics as the major ones separating four distinct groups of learning disabled children is a reflection of the training and experience of the professionals involved in assessing these children.

Group 1 for the 4H Group, 24 Variable Solution (Figure 3) indicated a group with relatively low intelligence and moderate visual

perception problems. This group could consist of children who have been overpredicted to meet the criteria of a program for learning disabled children, when in fact they would be more receptive to a program for borderline mentally retarded children. The pace and emphasis of a program for learning disabled children may be inadequate of a program for learning disabled children may be inadequate and very frustrating for the type of children designated in this group. They may need a program emphasizing more concrete simple cognitive tasks at a slower pace. One would not notice the erratic gains among the mentally retarded as are noticed with learning disabled children.

Group 2 (Figure 3) indicated a group with average intelligence and a very low visual perception problem. This group may also be as a result of overpredictive selection instruments. Assessment of this group predicted they would achieve better than they actually did in the classroom setting. This could be a function of a program in which the teacher is expecting a higher level of achievement than they are actually capable of producing. Children with behavior problems might also be experiencing a discrepancy in what they are capable of doing and what is being evaluated as a learning problem. These children could not be considered as having learning disabilities as defined by their placement on the root axis of general intelligence and visual perception problems.

Group 3 (Figure 3) indicated a group with average intelligence and a severe visual perception problem. These children could benefit from a visual perceptual remedial program paced for children with above average intelligence. It is also possible that children with behavior

problems are being picked up in this group since there is such a distinct separation of group 3 and group 4 on the general intelligence factor. Because they are bright, they are scoring high on the intelligence factor, but severe behavior problems (such as distractibility, hyperactivity, etc.) could be mislabeling them "learning disabled."

In examining the remedial program used by Sparta with the analytical knowledge provided from this analysis, one could evaluate whether or not a group of children had been misprescribed in the type of treatment they are receiving. One is able to evaluate an assessment program in operation through the use of discriminant analysis. Children are being separated into district groups because of two major factors--their general intelligence and visual-perceptual problems. Is that what a particular program wants its assessment program to emphasize? Is this classification schemata appropriate for the school-age population in question?

Prescriptions could be written up for each of the group characteristics taken into account. At the end a product evaluation could be made--Did these prescriptions make a significant difference in the group of learning disabled children for which it was written? Did taking level of intelligence and level of visual perception problem into account make any difference? Was a program for group 1 based on a program for the mentally retarded more effective than one for learning disabilities? After group 2 was placed in a program for average intelligence, low visual perceptual problems, did it make any difference? After behavior modification techniques were applied to group 4, did it make any difference in their achievement? Does group

4 now seem to qualify as learning problems or behavior problems? Is group 3 functioning well in a curriculum for learning disabled children with severe visual perceptual problems?

The highest contributing factor to root 1 was the WISC subtest, general information. It is interesting to note that the vocabulary subtest was an insignificant contributor on all three DISCRM analysis although it is considered by some authors as one of the most highly contributing subtests to the general intelligence function. With this particular sample, however, the vocabulary subtest did not contribute significantly to a differentiation in intelligence. The highest loading test factor on root two was the ITPA subtest, visual closure. The visual closure task assesses the child's ability to identify a common object from an incomplete fisual presentation. It deals with a very specific type of visual perception problem assessing the child's ability to fill in the missing parts in an incomplete picture. The norms for General Information (WISC) and for Visual Closure (ITPA) with the raw score points for each child in this study are presented in Table 5, 8 and 9. This gives one a visual representation of where this learning disabled population is falling in relation to the normal school-age population.

In order to predict into which groups future school-age children assessed at Sparta would fall, a prediction equation could be set up as in the following example.

In the pilot study, weighted z scores would be obtained in order to make a comparison of a new student's raw z score range in relation to the weighted z score ranges.

Each variable (subject) had 41 observation scores. The means for each observation for each subject would first need to be determined. Then 41 standard deviations for each of the 53 subjects would be computed and from this information 41 raw z scores for each of the 53 subjects would then be determined using the following formula for the z score: (Glass and Stanley, 1970).

$$z_{r(\text{Var } 1\ldots41)} = \frac{X_{(\text{Var } 1\ldots53)} - \bar{X}_{(\text{Var } 1\ldots53)}}{\sigma_{\bar{X}(\text{Var } 1\ldots53)}}$$

$$z_w = W_{(\text{weight for Var } 1\ldots53)} \; X \; z_{r(\text{Var } 1\ldots53)}$$

For example, the wt. z score for the WISC total verbal score was -.13 ($z_r = \frac{6 - 10}{2} = -2; z_w = -2 \times .0638 = -.13$) over the total score ranges for Group 1 (Figure 3). The wt. z score for Group 2 was .01, the wt. z score for Group 3 was .10, for Group 4 was .35. The norm score for the WISC total Verbal score is 10 (Wechsler,). Eight year old student A, on entering the Special Education program, was determined to have specific learning disabilities. His total Verbal WISC score was 17. His raw z score was 2.5 ($z_r = \frac{17 - 10}{3} = 2.5$). Using the wt. z score table determined for each variable in the pilot study, his wt. z score was determined to be .38. Thus, his wt. z score would fall into the range of group 4 (Figure 3). His program could be based on the basic program established for a group in which a high intelligence factor and severe visual perception problem are significantly prevalent problems.

This standard weight range could then be plotted on a graph to give the special education staff a guide as to which group this child would have characteristics most similar of the problems faced by the

students in that group. This would in turn give the teacher an idea of the type of remedial program to set up for that particular child based on the group characteristics with which he was identified.

It has been shown that through an analytical interpretation of common gruop characteristics among a sample of learning disabled children, several pertinent questions can be answered.

1. What are the elements of the educational policy that have been designated as a result of the analysis? Is this type of policy the school program wishes to pursue?

2. What are the group characteristics for each group as designated by the analysis? Are they relevant to the group under consideration?

3. What type of prescriptions would be recommended based on the group characteristics designated by the analysis? After the prescriptions have been applied, was any significant changes noted in the group specific for that remedial program?

Recommendations

It appears that the stage is set for a number of things to happen in the classification process of learning disabled children. On the basis of the literature and the present study a number of recommendations are made.

First, there is a need for more comparisons of these group characteristics another defined groups in the learning disabled population, in order to further investigate common characteristics that separate distinct groups of children with learning disabilities, within a given program.

Second, there is a need for detailed investigation into the background of the educational policies that are used to assess learning disabled children so that more accurate programs based on specific group characteristics that are analyzed can be developed. Such questions

as what are the major emphasis in teacher-training programs for learning disabilities and what characteristics of learning disabilities are emphasized as the most important in assessment need to be asked. The overall question here would be, what is the analysis implying concerning the intuitive policy of a school program? Does it meet the standard educators we're aiming for?

Third, there is a need to investigate the types of remedial programs going on in classrooms for the learning disabled in order to evaluate their effectiveness based on the group characteristics shared by children in the room that are on specific prescriptive programs. Does the program match the descriptive characteristics of the distinct groups determined by the application of DISCRM analysis to specific grouping procedures such as HGROUP?

Information secured from the above points to the need for educators to re-evaluate the present classification-assessment system for learning disabled children. Divoky (1974) warns that a general label such as "learning disabled" is likely to do more harm than good. She concludes:

> "Wide use of the gross label (learning disabilities) can lead to greatly erroneous expectation with respect to the behavior of individual children. Unfortunately, there is little agreement either in medicine or in education as to the criteria which should be used to identify children with learning disabilities...the search for any commonality in symptoms, pathology, or etiology has, so far, been fruitless..."General terms such as undefined learning disabilities has no consistent meaning and no value as a basis either for the development or application of corrective methods." (Divoky, 1974)

If the classification-assessment system could be directed through the use analytical grouping techniques, identification of group characteristics might make more parsimonious decisions possible.

Summary of Research Questions

	Research Question	Disposition
1.	Given 53 variables each measured on 41 different observations, does there exist natural groups among the 53 variables which are the most similar in their scores on the 41 observations used to describe them?	Yes[a]
2.	Can a set of factors be interpreted for teacher behavior checklist that can be used to balance the weight of the behavior checklist observations with the other test score observations for the subject variables?	Yes[b]
3.	Given the most homogeneous groupings of 53 variables measured on 41 different observations, can characteristics significantly distinguishing each group from one another be identified?	Yes[c]

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a. Applies to 4HGROUP Solution, Error score = 91.4.

b. Applies to principal factor solution with 8 interpretable factor-distractibility, comprehension-memory cognitive problems, visual perception problems, perseveration-memory problems, abstract spatial and temporal concepts problems, emotional liability, visual dissociation, and auditory-perceptual problems.

c. Applies to the most significantly highly correlating test score variables with Root I and Root IV of multiple discriminant analysis applied to a 4HGROUP, 24 Variable solution. The highest loading factor on Root I was the WISC subtest-General information, $p = .6658$, $p = .001$. The highest loading factor on Root IV was the ITPA subtest-Visual Closure, $r = .6568$, $p = .0001$.

TABLE 1

Variables Used in Data Analysis

X_1 IQ Verbal scale WISC (V_{IQ})
X_2 IQ Performance scale WISC (P_{IQ})
X_3 IQ Full scale WISC (FS_{IQ})
X_4 Verbal full scale score (V_{ss})
X_5 Performance full scale score (P_{ss})
X_6 Full scale score (V -P FS) (FS_{ss})
X_7 WISC, General information scaled scores (V_1)
X_8 WISC, General Comprehension scaled scores (V_2)
X_9 WISC, Arithmetic scaled scores (V_3)
X_{10} WISC, Similarities scaled scores (V_4)
X_{11} WISC, Vicabulary scaled scores (V_5)
X_{12} WISC, Digit span scaled scores (V_6)
X_{13} WISC, Picture completion scaled scores (P_1)
X_{14} WISC, Picture arrangement scaled scores (P_2)
X_{15} WISC, Block design scaled scores (P_3)
X_{16} WISC, Object assembly scaled scores (P_4)
X_{17} WISC, Coding scaled scores (P_5)
X_{18} Bender Gestalt developmental age score (DA)
X_{19} Wepman Auditory Discrimination proportional error score (RS)
X_{20} ITPA, Auditory Reception scaled score (AR)
X_{21} ITPA, Visual reception scaled score (VR)
X_{22} ITPA, Visual sequential memory scaled score (VM)
X_{23} ITPA, Auditory association scaled score (AA)
X_{24} ITPA, Auditory sequential memory scaled score (AM)
X_{25} ITPA, Visual Association scaled score (VA)
X_{26} ITPA, visual Closure scaled score (VC)
X_{27} ITPA, Verbal Expression scaled score (VE)
X_{28} ITPA, Grammatic closure scaled score (GC)
X_{29} ITPA, Manual Expression scaled score (ME)
X_{30} ITPA, Auditory closure scaled score (AC)
X_{31} ITPA, Sounds blending scaled score (SB)
X_{32} ITPA, psycholinguistic age (PLA)
X_{33} ITPA, mental age (MA)
X_{34} Behavior checklist, Distractibility factors (F_1)
X_{35} Behavior checklist, Comprehension-memory cognitive factor scores (F_2)
X_{36} Behavior checklist, Spatial orientation-visual perception problem factor score (F_3)
X_{37} Behavior checklist, Perseveration-memory problem factor scores (F_4)
X_{39} Behavior checklist, Emotional stability factor scores (F_6)
X_{40} Behavior checklist, Visual dissociation (F_7)
X_{41} Behavior checklist, Auditory-perceptual problem factor score (F_8)

TABLE 2

Description of 8 Factor Loadings from the Behavior Checklist

Factor 1 - Distractibility

Items contributing

2, 3, 4, 5, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 28, 30, 34, 40

Behavior Descriptives of Distractibility Based on Above Items

Easily frustrated gives up easily, inability to cope with new situations, change in routine, plays with items on his desk, looks around the room while working on assigned tasks, unable to concentrate on task for a very long period of time, has trouble completing assignments before jumping into something else, can't sit still for a minute, wanders aimlessly about the room, follows no logical pattern in his behavior, acts before thinking, very slow to respond...

Distractibility - Tendency for one's attention to be drawn easily to extraneous stimuli or to focus on minor details with lack of attention to major aspects.

Factor 2 - Comprehension-Memory Cognitive Problems

Items contributing

8, 26, 28, 29, 35, 37, 47, 56, 57, 58, 59

Behavior descriptives of Comprehension-Memory Cognitive Problems Based on Above Items

Has trouble remembering things, low on vocabulary comprehension, difficulty in comprehending arithmetic, difficulty in silent reading, difficulty in spelling, recognizes a word one day and not the next, can't memorize multiplication tables, exhibits inability to combine presented phonemes into a whole word, not able to sequence sounds or words, not able to structure sentences.

Comprehension-Memory Cognitive Problems - Problems in one's approach to problem solving and cognitive tasks involving comprehension and memory skills.

Factor 3 - Visual Perception Problem

Items contributing

7, 25, 28, 32, 33, 36, 54, 55, 64, 65, 66, 67

TABLE 2 (Cont)

Behavior descriptives of Spatial Orientation-Visual Perception Problem Based on Above Items

Has trouble following simple directions, has trouble in arithmetic, has reversal problems of b, d, u, n, ...leaves or skips words in reading, has trouble organizing information which is presented visually, does not communicate with gestures, handwriting is very poor, reverses letters and numbers, rotates letter and numbers, makes reversal errors in reading.

Visual Perception Problem--Problems with the interpretation of sensory information presented visually.

Factor 4 - Perseveration-Memory Problems

Items contributing

3, 18, 19, 32, 44, 45, 46

Behavior descriptives of Perseveration-Memory Problem Based on Above Items

Has trouble following multiple directions, keeps on doing a task after it is finished, repeats excessively a task or movement displaying an inability to change, has reversals of b, d, u, n, not able to remember sequences given orally, exhibits difficulty in remembering his telephone number and address, cannot count.

Perseveration-Memory Problem - Continuation of a response when it is no longer appropriate.

Factor 5 - Abstract Spatial and Temporal Concepts

Items contributing

61, 62, 63

Behavior descriptives of Abstract Spatial-Temporal Concepts Based on Above Items

Poor understanding of the concept of time, inability to distinguish directions, poor understanding of spatial concept-up, down, before, after...

Abstract Spatial and Temporal Concepts--Problems with the comprehension of the position of two or more objects in relation to oneself and in relation to each other; problems with the concept of time.

TABLE 2 (Cont)

Factor 6 - Emotional Lability

Items contributing

1, 10, 11, 24, 25

Behavior descriptives of Emotional Stability Based on Above Items

Inability to get along with others, not responsive or friendly in his relationship with teacher, class, ...

Emotional Lability--Tendency toward cyclic emotional behavior characterized by sudden inexplainable shifts from one emotion to another.

Factor 7 - Visual Dissociation

Items contributing

31, 38, 48, 49, 50, 51, 53

Behavior descriptives of Visual Dissociation Based on Above Items

Has difficulty with likenesses and differences, has problems with abstract reasoning and thinking, can't tell a story from pictures, has difficulty arranging pictures sequentially, has trouble matching objects, does not notice objects in a picture, has trouble imitating other children in games...

Visual Dissociation--The inability to see things, as a whole, the tendency to respond to a stimulus in terms of parts or segments.

Factor 8 - Auditory-Perceptual Problem

Items contributing

39, 41, 42, 43, 57, 60

Behavior descriptives of Auditory-Perceptual Problems Based on Above Items

Will raise his hand, but give an unrelated answer, can't follow oral directions, difficulty in remembering words when talking, has hard time expressing ideas, displays articulation problems, mispronounces words commonly used...

Auditory-Perceptual Problem--Problems with the interpretation of sensory information presented aurally.

TABLE 3

Factor Analysis

Varimax Loadings and Response Order for the Highest Loading Behavior Checklist Ite

V load	F_1 Q-R Order	V load	F_2 Q-R Order	V load	F_3 Q-R Order	V load	F_4 Q-R Order	V
				-.5169	7			
.4975	2	.4624	8	.6303	-25	.5300	6	
.6215	3	-.8398	-26	-.3287	28	.3988	18	
-.4890	-4	-.3479	28	-.5462	32	.4564	19	
-.6546	-5	.7199	29	-.6461	33	.4722	32	
.5718	9	.6538	35	-.5857	36	.6311	44	
-.3735	-10	.5959	37	-.4551	54	.7925	45	
.6564	12	.5469	47	-.6286	55	.7149	46	
.7218	13	.6410	56	.6882	-64			
.6322	14	.4023	57	.7491	-65			
.6692	15	.4705	58	.6461	-66			
.7903	16	.5401	59	.4442	-67			
.7422	17							
.3988	18							
.5821	19							
.5599	22							
.5098	23							
.3167	28							
.4707	30							
.5185	34							
-.4748	40							

V load	F_6 Q-R Order	V load	F_7 Q-R Order	V load	F_8 Q-R Order
-.4700	-1	.5166	31	.6846	39
-.3740	-10	.6472	38	.6968	41
-.6440	-11	.5935	48	.6863	43
.4996	-24	.7137	49	.6446	57
.5206	-25	.6560	51	.6631	60
		.5603	53		

TABLE 3

Factor Analysis

gs and Response Order for the Highest Loading Behavior Checklist Items on Factors 1-8.

der	V load	F_2 Q-R Order	V load	F_3 Q-R Order	V load	F_4 Q-R Order	V load	F_5 Q-R Order
			-.5169	7				
	.4624	8	.6303	-25	.5300	6	-.7468	-61
	-.8398	-26	-.3287	28	.3986	18	-.7164	-62
	-.3479	28	-.5462	32	.4564	19	-.7857	-63
	.7199	29	-.6461	33	.4722	32		
	.6538	35	-.5857	36	.6311	44		
	.5959	37	-.4551	54	.7925	45		
	.5469	47	-.6286	55	.7949	46		
	.6410	56	.6882	-64				
	.4023	57	.7491	-65				
	.4705	58	.6461	-66				
	.5401	59	.4442	-67				

der	V load	F_7 Q-R Order	V load	F_8 Q-R Order
	.5166	31	.6846	39
	.6472	38	.6968	41
	.5935	48	.6863	43
	.7137	49	.6446	57
	.6560	51	.6631	60
	.5603	53		

TABLE 4

Results of HIERARCHICAL GROUPING ANALYSIS FOR THE 5 GROUP, 4 GROUP, 3 Group Solution

5 Groups After Combining G 2 (N =13) and G 12 (N =7). Error = 87.5

	Subjects									
G 1 (N = 16)	1	3	4	7	9	11	13	17	27	30
	34	36	39	46	52	54				
G 2 (N = 20)	2	10	12	18	21	22	24	28	29	31
	33	37	40	42	43	44	45	46	53	58
G 5 (N = 12)	5	6	14	15	16	19	20	25	26	32
	35	51								
G 8 (N = 4)	8	23	47	57						
G 38 (N=1)	38									

4 Groups After Combining G 2 (N =20) and G 38 (N = 1). Error = 91.4

	Subjects									
G 1 (N = 16)	1	3	4	7	9	11	13	17	27	30
	34	36	39	46	52	54				
G 2 (N = 21)	2	10	12	18	21	22	24	28	29	31
	33	37	38	40	42	43	44	45	48	53
	58									
G 5 (N = 12)	5	6	14	15	16	19	20	25	26	32
	35	51								
G 8 (N = 4)	8	23	47	57						

3 Groups After Combining G 2 (N =21) and G 5 (N = 12). Error=117.2

	Subjects									
G 1 (N = 16)	1	3	4	7	9	11	13	17	27	30
	34	36	39	46	52	54				
G 2 (N=33)	2	5	6	10	12	14	15	16	18	19
	20	21	22	24	25	26	28	29	31	32
	33	35	37	38	40	42	43	44	45	48
	51	53	58							
G 8 (N = 4)	8	23	47	57						

TABLE 5

MULTIPLE DISCRIMINANT ANALYSIS

4 HGROUP, 41 VARIABLE SOLUTION

	N	CENTROID	ROOT 1	2	3
GROUP 1	16	1	17.5318	-8.9909	-9.2013
GROUP 2	21	2	24.1436	-9.5512	-7.8683
GROUP 3	12	3	22.0738	-6.7209	-7.9006
GROUP 4	4	4	29.0506	-8.1351	-11.3094

WILKS LAMBDA .001, F-RATIO 2.39, P .005

ROOT 1 69.24 PCT. VARIANCE, CHI-SQUARE 107.62, D.F. 43, P .0000

ROOT 2 25.84 PCT. VARIANCE, CHI-SQUARE 79.03, D.F. 41, P .0007

ROOT 3 4.92 PCT. VARIANCE, CHI-SQUARE 36.87, D.F. 39, P .5674

4 HGROUP, 33 VARIABLE SOLUTION

	N	CENTROID	ROOT 1	2	3
GROUP 1	16	1	16.3619	-6.0705	8.9586
GROUP 2	21	2	23.7646	-1.4839	9.9565
GROUP 3	12	3	22.6472	-9.4457	11.3409
GROUP 4	4	4	30.7866	-10.3731	7.1472

WILKS LAMBDA .007, F-RATIO 2.16, P .0016

ROOT 1 75.89 PCT. VARIANCE, CHI-SQUARE 93.067D.F. 35, P .0000

ROOT 2 18.08 PCT. VARIANCE, CHI-SQUARE 50.32 D.F. 33, P .0300

ROOT 3 6.03 PCT. VARIANCE, CHI-SQUARE 25.58 D.F. 31, P .7395

4 HGROUP, 24 VARIABLE SOLUTION

	N	CENTROID	ROOT 1	2	3
GROUP 1	16	1	16.4726	-4.9828	6.0616
GROUP 2	21	2	22.7873	1.0011	7.7553
GROUP 3	12	3	22.6889	-8.4359	9.7062
GROUP 4	4	4	30.9558	-8.0049	3.4311

WILKS LAMBDA .015, F-RATIO 3.31, P .0000

ROOT 1 72.49 PCT. VARIANCE, CHI-SQUARE 90.99 D.F. 26, P .0000

ROOT 2 22.91 PCT. VARIANCE, CHI-SQUARE 53.51, D.F. 24, P .0009

27

TABLE 6

MULTIPLE DISCRIMINANT ANALYSIS
CORRELATIONS

	4GROUP, 41 V		4GROUP, 33V		4GROUP, 24 V	
	ROOTS		ROOTS		ROOTS	
VARIABLES	1	2	1	2	1	2
V_{IQ}	.6954	.2460				
P_{IQ}	.5165	.2949				
FS_{IQ}	.7408	.3552				
V_{SS}	.4510	.3302				
P_{SS}	.1479	-.0779				
FS_{SS}	.7364	.3529				
V_1	.6277	.1022	.6516	-.0624	.6658	.0270
V_2	.4416	.3317	.5004	-.4213	.5553	-.3513
V_3	.4741	.0150	.4816	.0500	.4806	.1153
V_4	.5099	.3614	.5671	-.3508	.6102	-.2781
V_5	.1547	-.0600	.1475	.0973		
V_6	.6075	.0175	.6104	.1617	.5937	.2384
P_1	.4395	.4415	.5087	-.4736	.5655	-.4087
P_2	.5279	.0931	.5457	-.0129	.5510	.0587
P_3	.1612	.2048	.1891	-.1714		
P_4	.3945	.0284	.4021	.0367	.4011	.0901
P_5	.1212	-.0029	.1188	.0700		
DA	-.1258	-.0065	-.1330	.0603		
RS	-.2042	.1462	-.1812	-.2658		
AR	.4543	.2705	.4907	-.1458	.5057	-.0892
VR	.6416	-.0409	.6428	.1425	.6331	.2301
VM	.2621	-.2166	.2262	.4090	.1782	.4349
AA	.5716	-.0222	.5789	.0504	.5814	.1330
AM	.5105	-.2486	.4751	.4482	.4267	.5105
VA	.4988	-.1527	.4847	.2207	.4666	.2903
VC	.3727	-.4628	.3100	.6100	.2461	.6568
VE	.4453	.1922	.4748	-.1198	.4900	-.0603
GC	.4159	.1266	.4342	-.0241	.4375	.0293
ME	.3711	.1003	.3863	-.0168	.3893	.0314
AC	.5160	-.2545	.4828	.4138	.4403	.4798
SB	.5041	-.3145	.4720	.3395	.4445	.4139
PLA	.7136	-.2966				
MA	.1434	.1897				
F_1	-.3926	.2039	-.3711	-.2504	-.3495	-.3061
F_2	-.2978	.0832	-.2890	-.1453		
F_3	-.3089	.4788	-.2441	-.6078	-.1803	-.6466
F_4	-.6074	.3751	-.5566	-.5906	-.4945	-.6267
F_5	-.3013	.0564	-.3051	.0130		
F_6	-.0597	-.0383	-.0846	.2515		
F_7	-.5607	-.0383	-.5720	-.0422	-.5723	-.1190
F_8	.3513	.0003	-.3565	-.0323		

TABLE 7

MULITPLE DISCRIMINANT ANALYSIS
UNIVARIATE F-TESTS

	4GROUP, 41 V		4GROUP, 33V		4GROUP, 24 V	
VARIABLES	F-RATIO	P (p .05)	F-RATIO	P	F-RATIO	P
V_{IQ}	18.7897	.0000				
P_{IQ}	8.5155	.0003				
FS_{IQ}	34.6625	.0000				
V_{SS}	9.9575	.0002				
P_{SS}	.5662	.6440				
FS_{SS}	31.3569	.0000				
V_1	11.0139	.0001	11.0139	.0001	11.0139	.0001
V_2	10.3169	.0001	10.3169	.0001	10.3169	.0001
V_3	4.5666	.0069	4.5666	.0069	4.5666	.0069
V_4	10.6583	.0001	10.6583	.0001	10.6583	.0001
V_5	.4633	.7131	.4633	.7131		
V_6	10.2518	.0001	10.2518	.0001	10.2518	.0001
P_1	11.5149	.0000	11.5149	.0000	11.5149	.0000
P_2	6.3046	.0014	6.3046	.0014	6.3043	.0014
P_3	1.1180	.3512	1.1180	.3512		
P_4	2.9268	.0421	2.9268	.0421	2.9268	.0421
P_5	.3762	.7736	.3762	.7736		
DA	.5570	.6500	.5570	.6500		
RS	1.6453	.1898	1.6453	.1898		
AR	6.1985	.0015	6.1985	.0015	6.1985	.0015
VR	10.9534	.0001	10.9534	.0001	10.9534	.0001
VM	4.0952	.0114	4.0952	.0114	4.0952	.0114
AA	7.9478	.0004	7.9478	.0004	7.9478	.0004
AM	9.7101	.0001	9.7101	.0001	9.7101	.0001
VA	5.8294	.0021	5.8294	.0021	5.8294	.0021
VC	9.8774	.0001	9.8774	.0001	9.8774	.0001
VE	4.7864	.0056	4.7864	.0056	4.7864	.0056
GC	3.7584	.0164	3.7584	.0164	3.7584	.0164
ME	2.7717	.0504	2.7717	.0504	2.7717	.0504
AC	8.7668	.0002	8.7668	.0002	8.7668	.0002
SB	8.4888	.0003	8.4888	.0003	8.4888	.0003
PLA	23.5394	.0000				
MA	1.1526	.3374				
F_1	3.7837	.0159	3.7837	.0159	3.7837	.0159
F_2	1.6991	.1782	1.6991	.1782		
F_3	8.5103	.0003	8.5103	.0003	8.5103	.0003
F_4	20.6437	.0000	20.6437	.0000	20.6437	.0000
F_5	2.4857	.0705	2.4857	.0705		
F_6	1.8330	.1522	1.8330	.1522		
F_7	7.2228	.0006	7.2228	.0006	7.2228	.0006
F_8	2.2495	.0931	2.2495	.0913		

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Table

Distribution of Scaled Scores for the WISC (V_1)

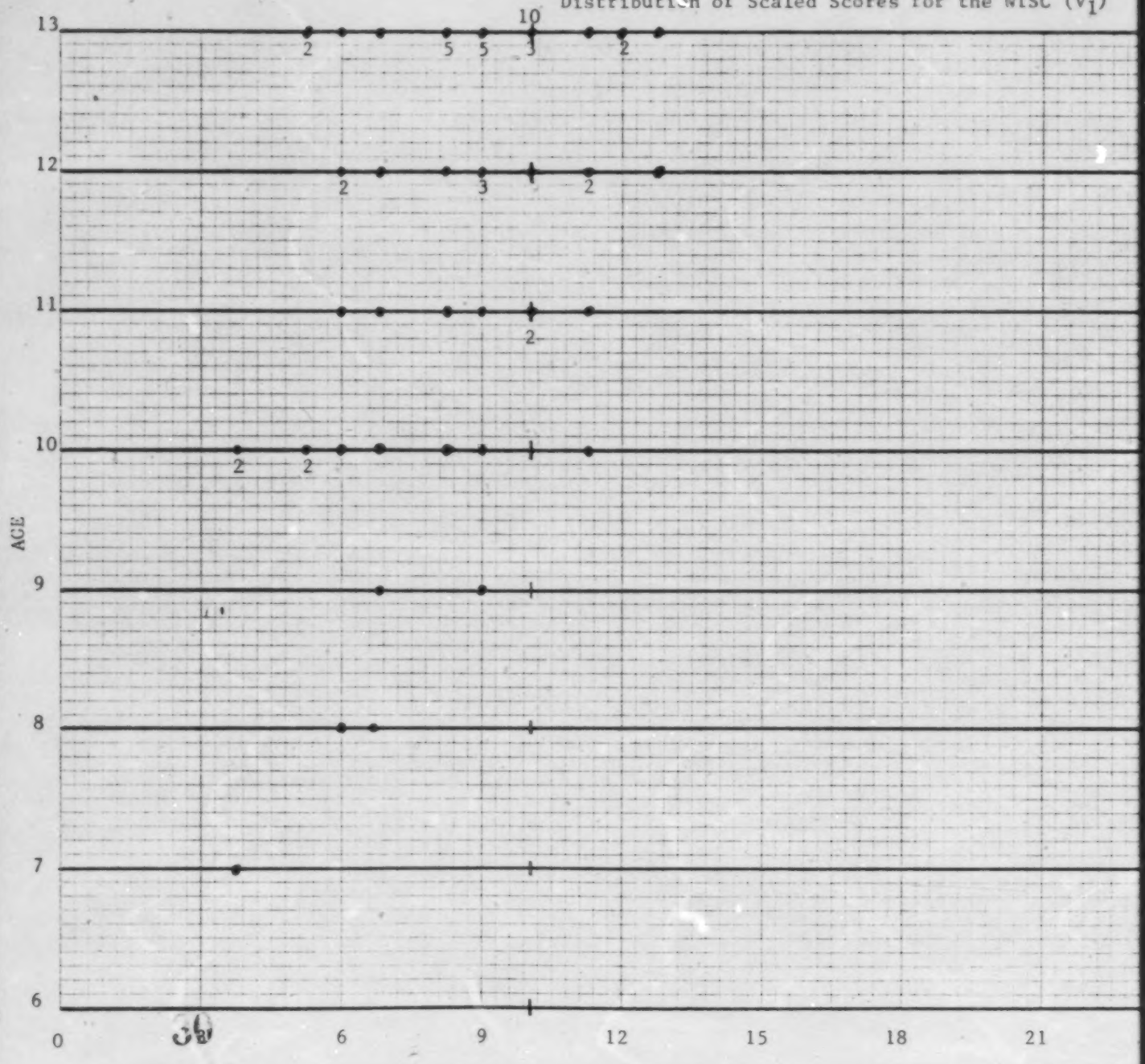

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Table
Distribution of Scaled Scores for the WISC (V_1)

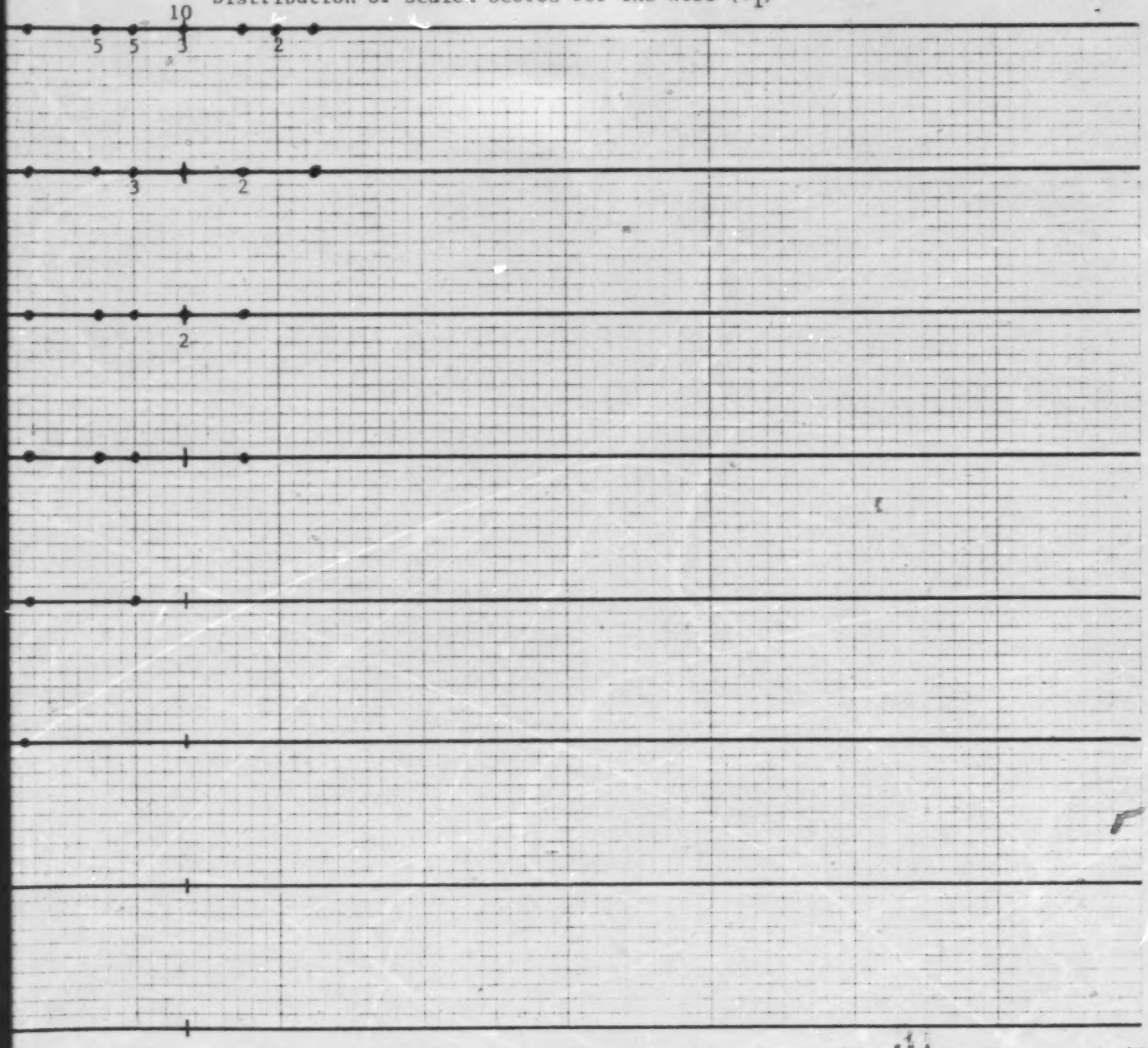

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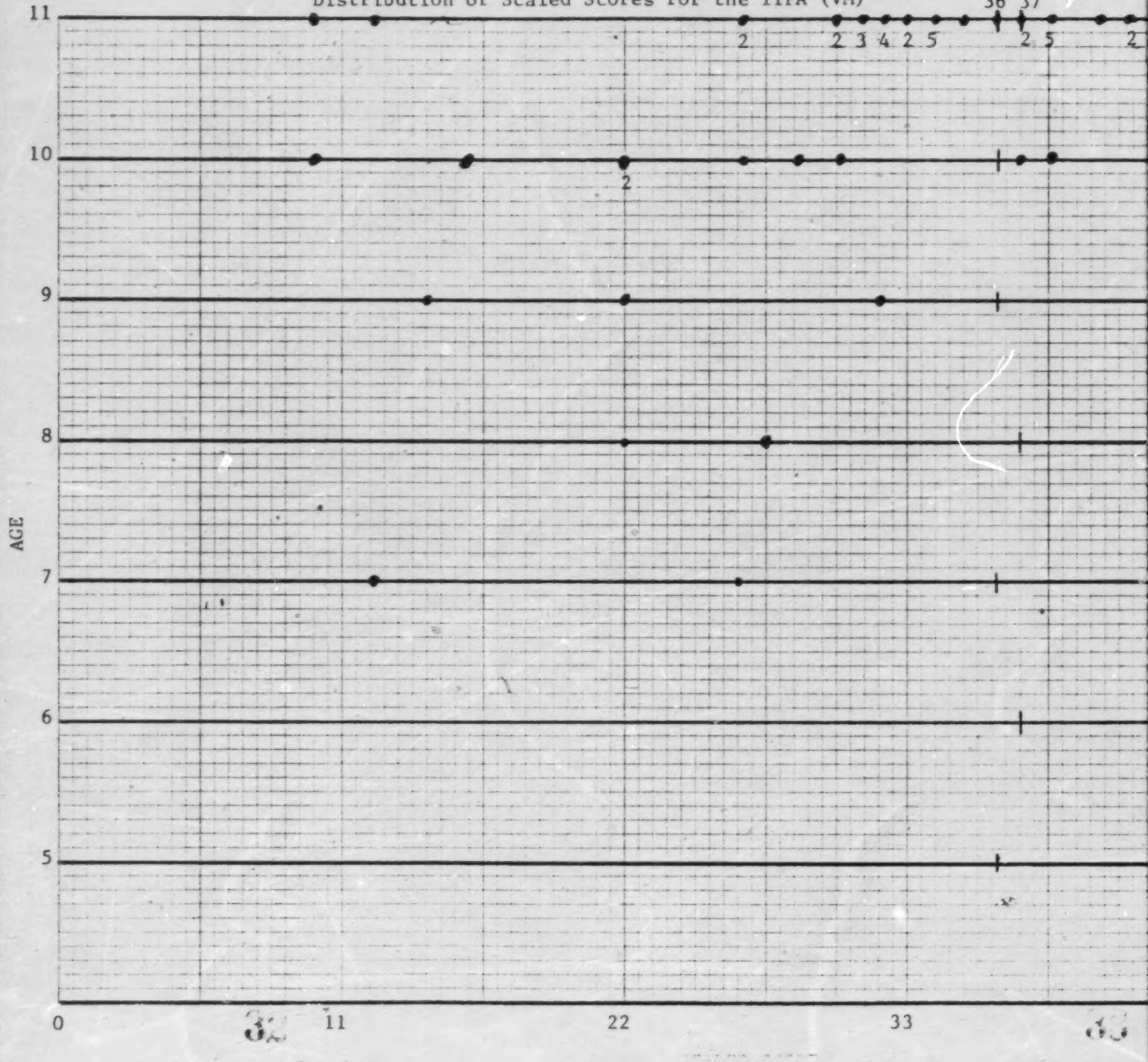
Table
Distribution of Scaled Scores for the ITPA (VM)



K·E 10 X 10 TO THE INCH • 5 X 10 INCHES
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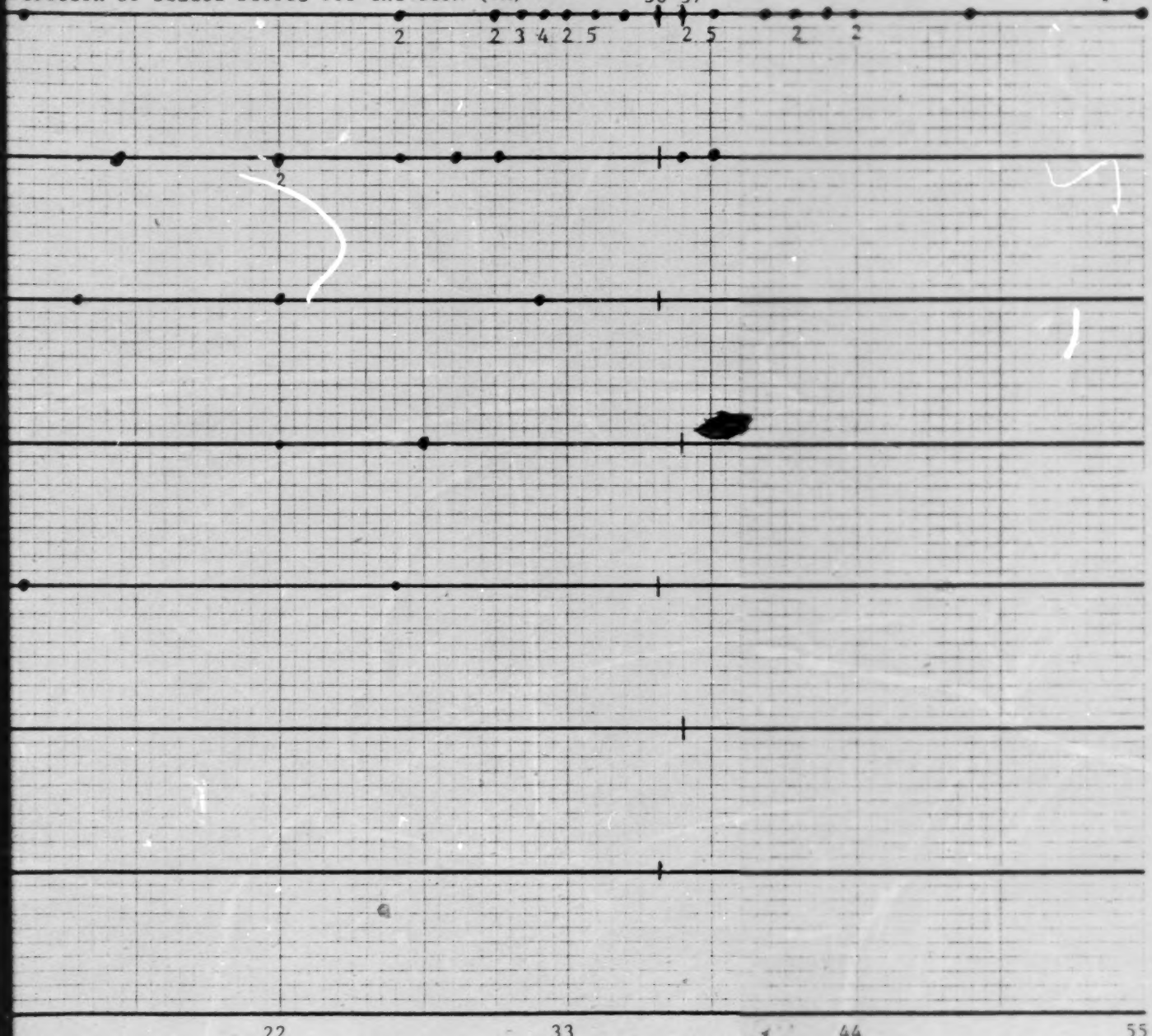
Table

ribution of Scaled Scores for the ITPA (VM)



K·E 10 X 10 TO THE INCH • 7 × 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

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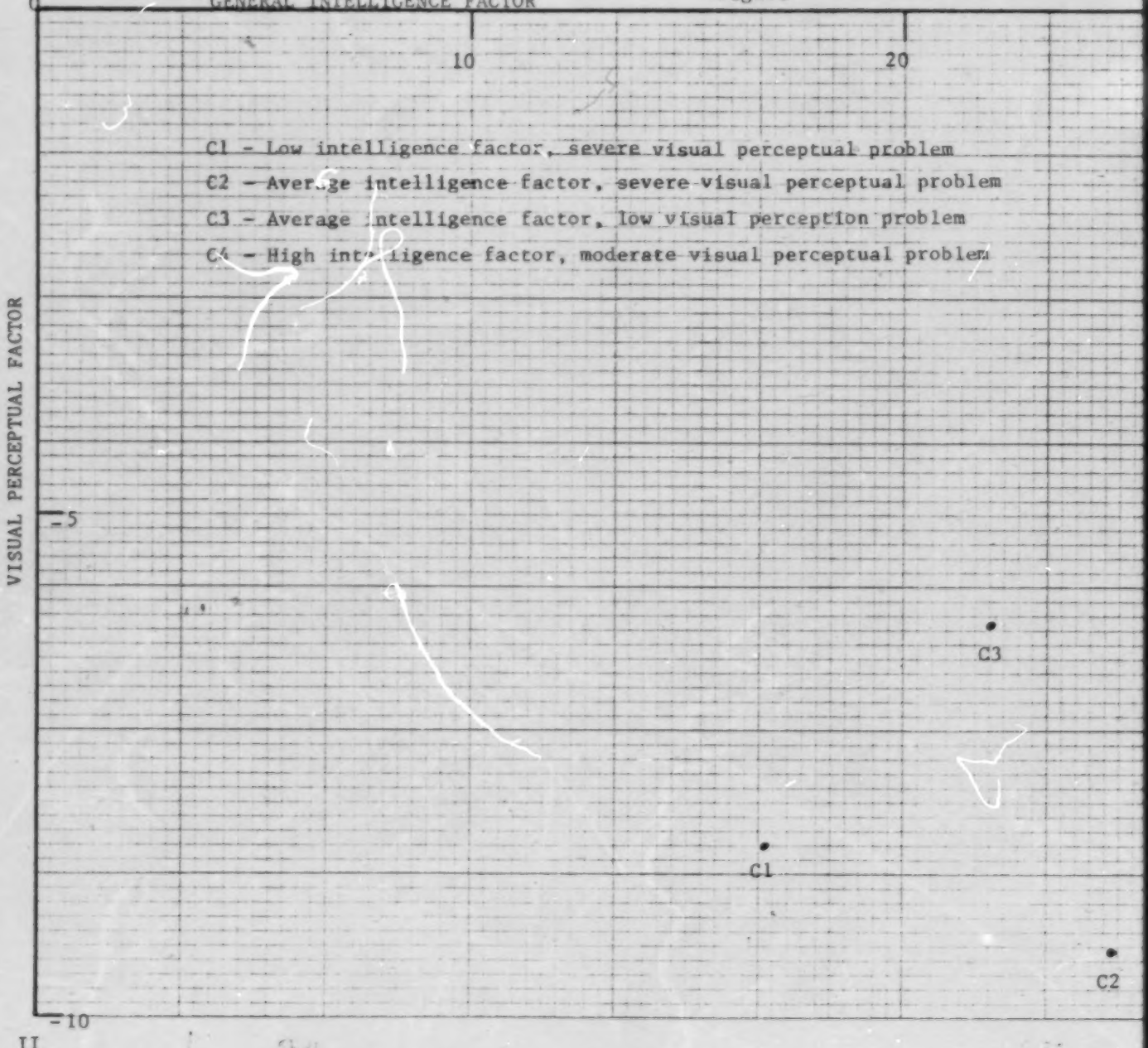
Figure



II

K·E 10 X 10 TO THE INCH • 7 X 10 INCHES
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Figure

ELLIGENCE FACTOR

I

10

20

30

telligence factor, severe visual perceptual problem

e intelligence factor, severe visual perceptual problem

e intelligence factor, low visual perception problem

ntelligence factor, moderate visual perceptual problem

C3

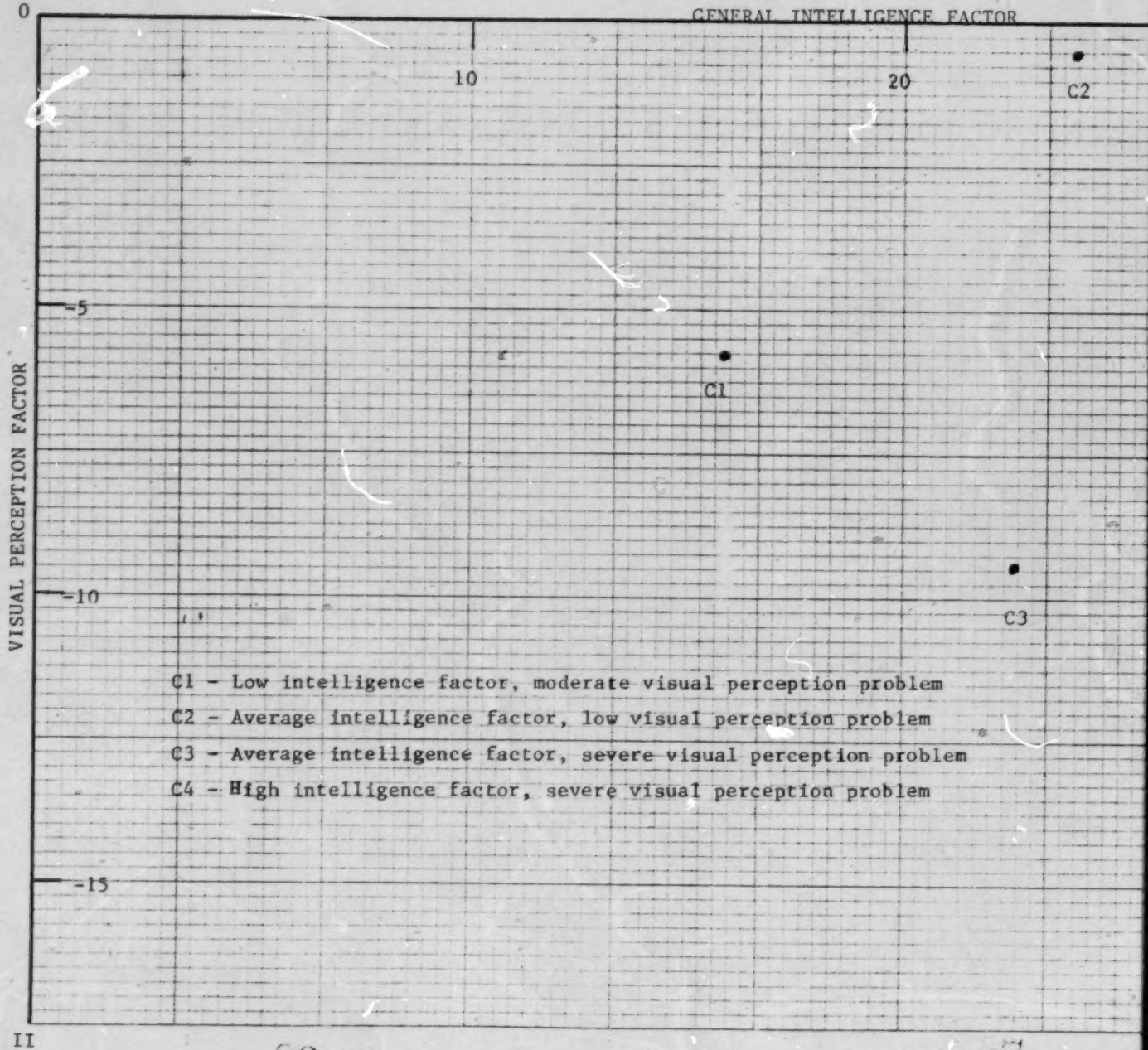
C4

C1

C2

K•E 10 X 10 TO THE INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure

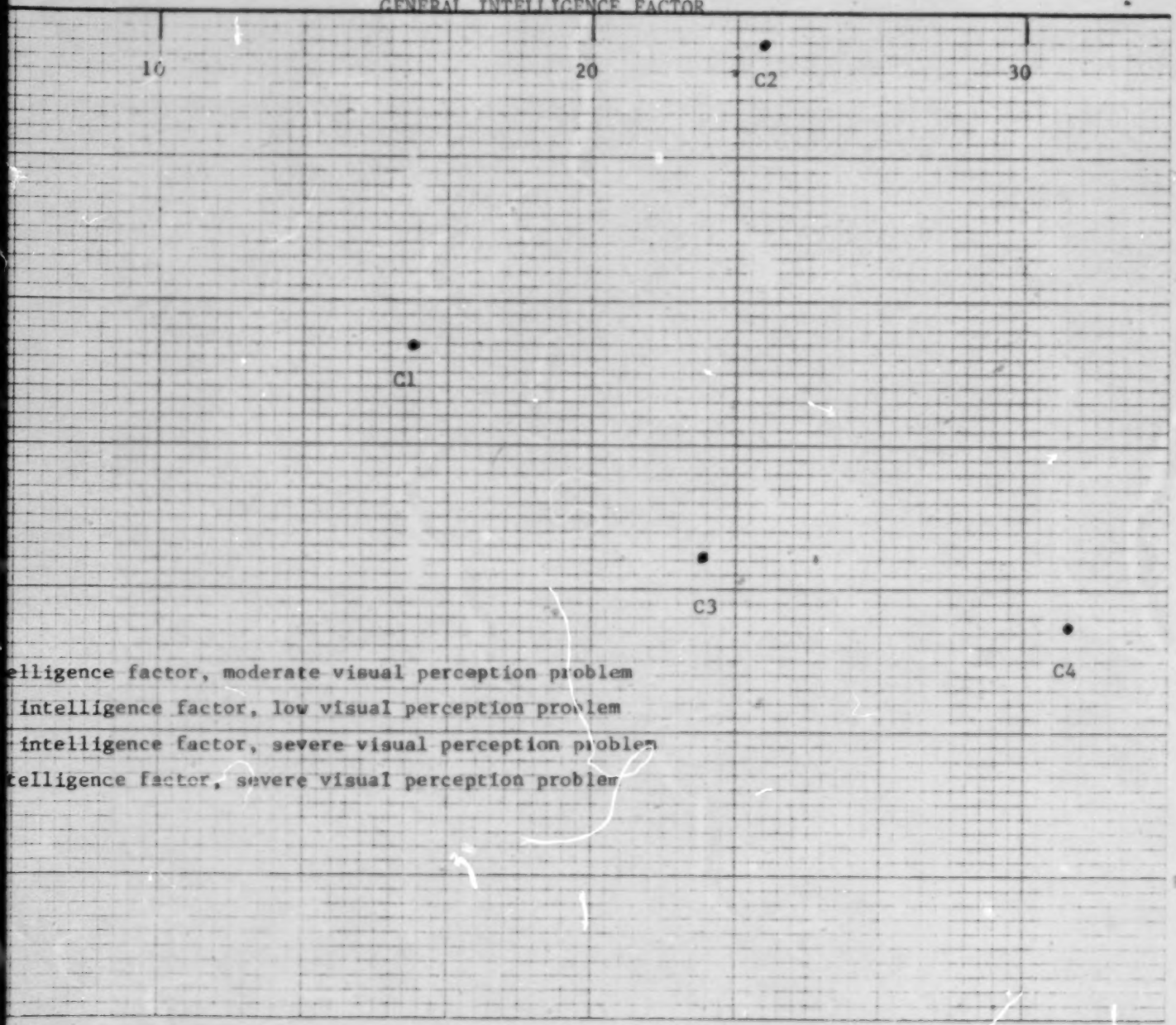


II

K·E 10 X 10 TO THE INCH KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure

GENERAL INTELLIGENCE FACTOR



elligence factor, moderate visual perception problem

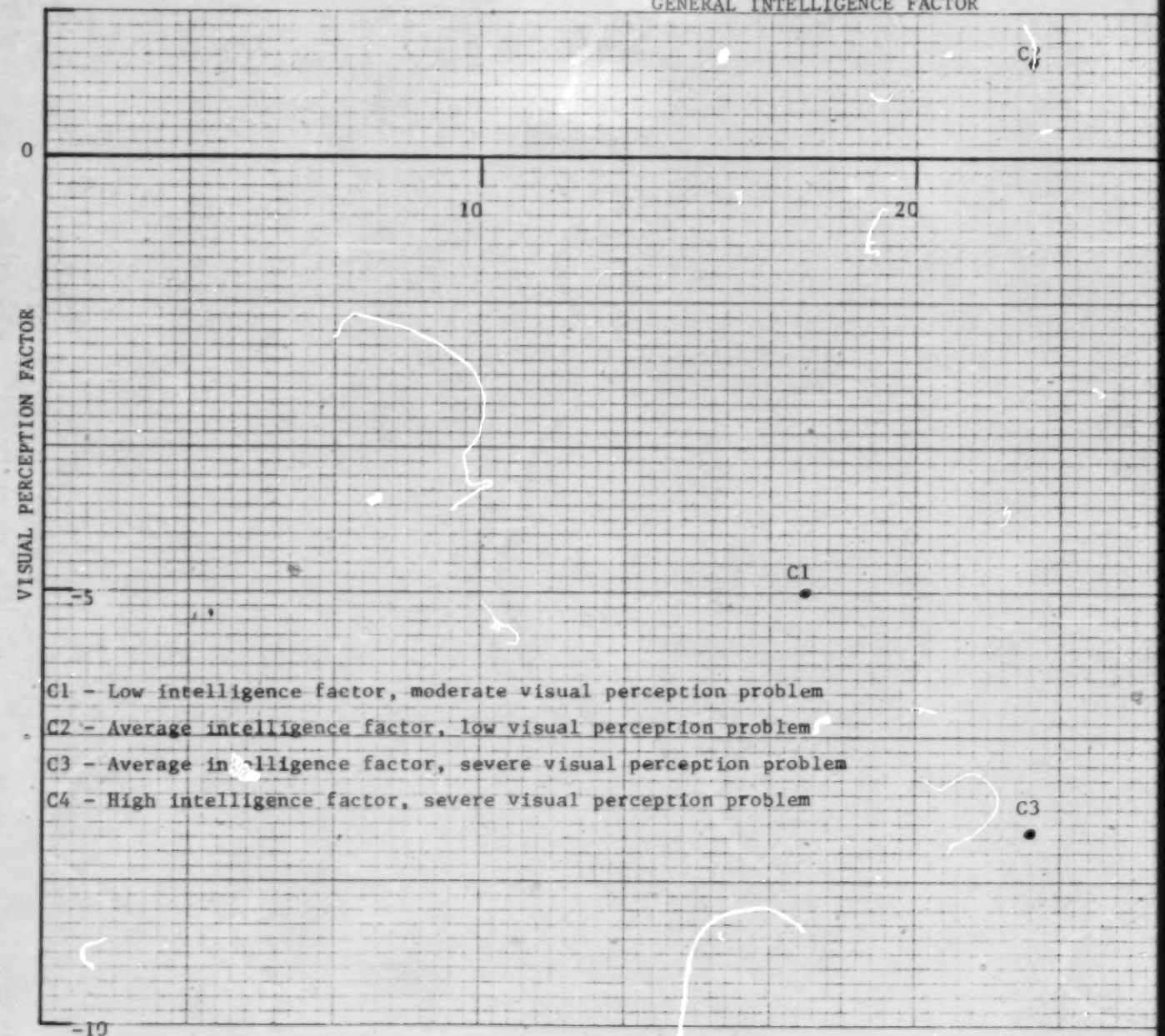
intelligence factor, low visual perception problem

intelligence factor, severe visual perception problem

telligence factor, severe visual perception problem

Figure

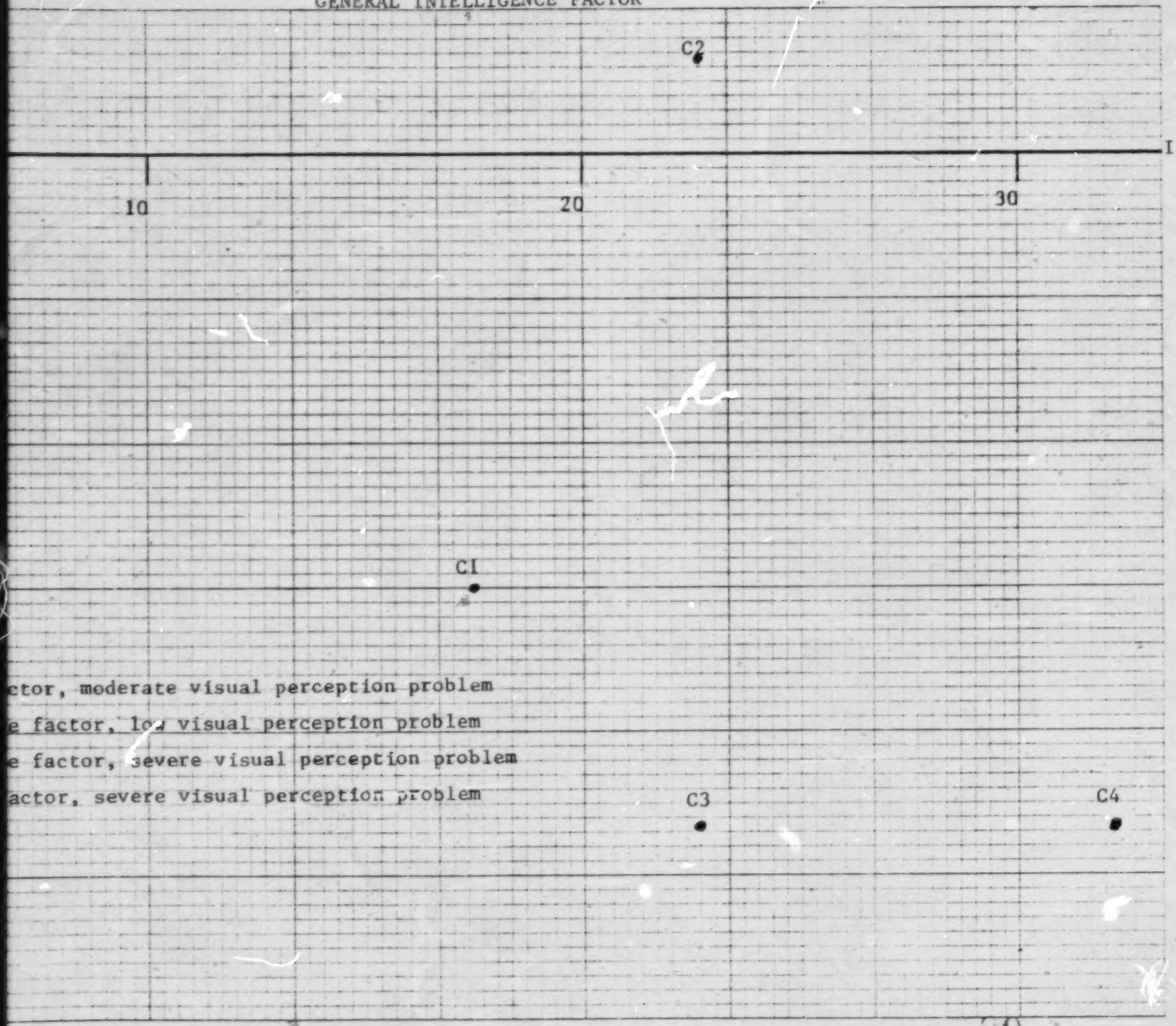
GENERAL INTELLIGENCE FACTOR



K•E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure

GENERAL INTELLIGENCE FACTOR



ctor, moderate visual perception problem

e factor, low visual perception problem

e factor, severe visual perception problem

actor, severe visual perception problem

MULTIPLE DISCRIMINANT ANALYSIS - 4HGROUP, 24 VARIABLE SOLUTION

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